How to Reclassify Raster Datasets in ArcGIS Pro

This tutorial will show you how to reclassify raster datasets using ArcGIS Pro (may require Spatial Analyst extension).

When to Perform a Reclassification?

Reclassifying the set values of a raster dataset allows the user to simplify the information in their raster.

For instance, reclassifying cells for soil type and erosion characteristics can help simplify the data by grouping classifications or setting identified cell values to 'NoData', removing it from the analysis altogether.

A few other examples of when to reclassify your data include animal habitat assessments, search and rescue models, site location analysis, natural disaster prediction models, etc.

Tutorial Scenario

For this tutorial, we are tasked with a hypothetical scenario of locating a site for a potential vineyard in Garrett County, MD.

The site location requires a south facing (160-200°) with a moderate grade (8-12%). In order to locate this site we need to import a LIDAR Image Service from https://lidar.geodata.md.gov/imap/rest/services, apply raster functions (slope and aspect) to the service and export our AOI (area of interest) for local processing.

With a local copy of the data, we can proceed with reclassifying the dataset and analyzing our results for locating a potential site for our project.

This tutorial consists of two methods for reclassifying raster datasets; the first of which requires Spatial Analyst toolbox, the second method utilizes raster functions in ArcGIS Pro and does not require additional software extensions.

Method 1: Using Spatial Analyst Toolbox

This method uses geoprocessing tools in the Spatial Analyst toolbox. You will need an active Spatial Analyst extension to perform the following tasks. If you do not have Spatial Analyst, please proceed to Method 2: Using ArcGIS Pro Raster Functions.

Reclassify Slope Data

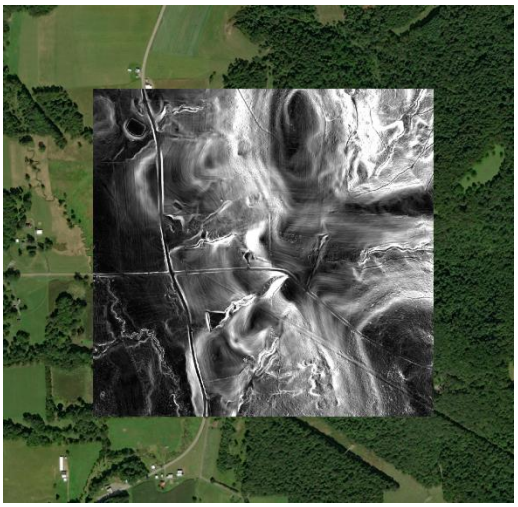
1. Open an existing project, or start a new map template, in ArcGIS Pro.

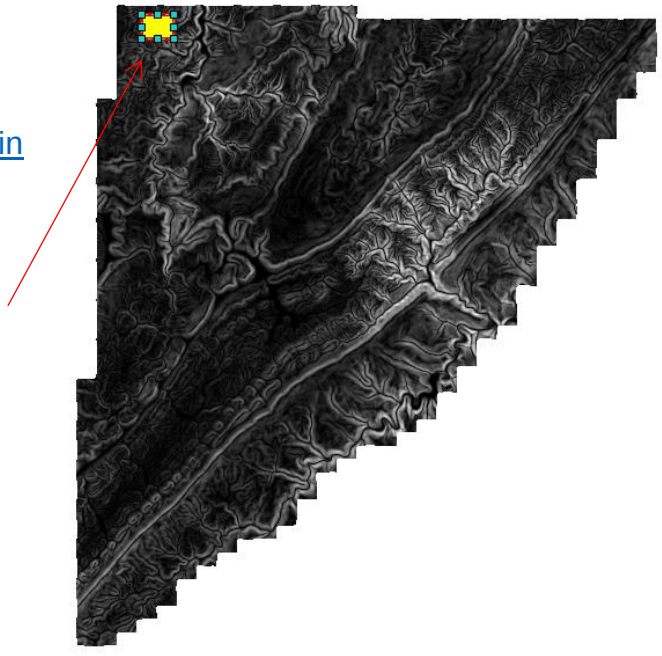
2. Add the desired Image Service to your map. [Example: Garrett_DEM_M]
   For more information on accessing Maryland LiDAR image services, please read How to Access Maryland LiDAR Image Services.
   Note: Raster functions are only available for the services within the [DEM_M] folder.

3. Apply the slope function to Garrett_DEM_m
   For more information on accessing image service functions, please read How to Access Image Service Functions in ArcGIS for Desktop.

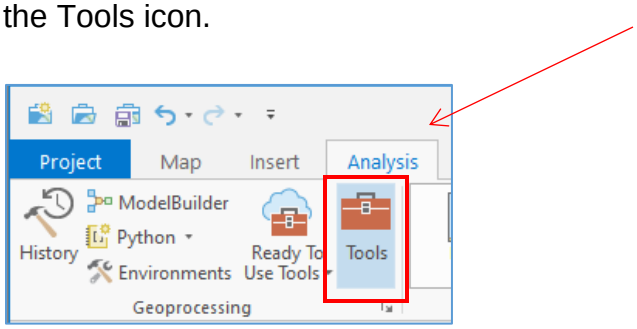
4. *For this tutorial we are clipping a region from the NW corner of Garrett County >>>*

   Extract your AOI (area of interest) from the image service to allow for local data processing. For more information on the image service extraction process, please read How to Extract from Image Services in ArcGIS for Desktop.

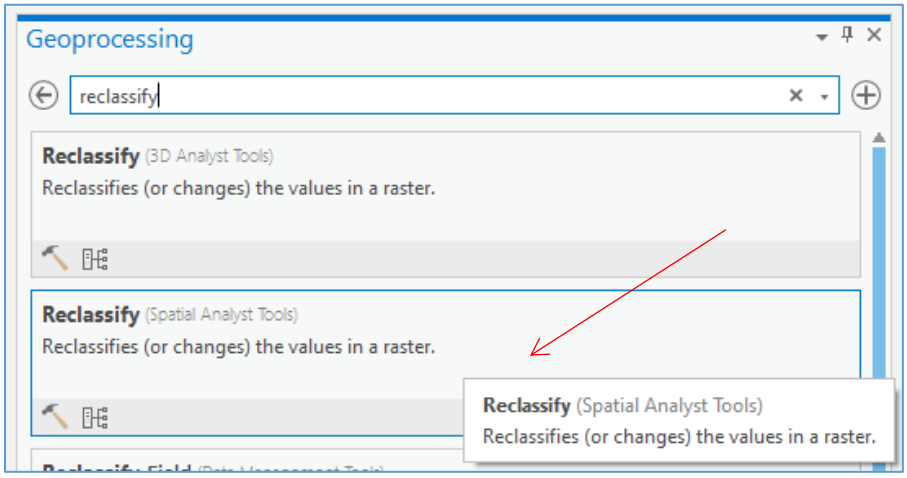




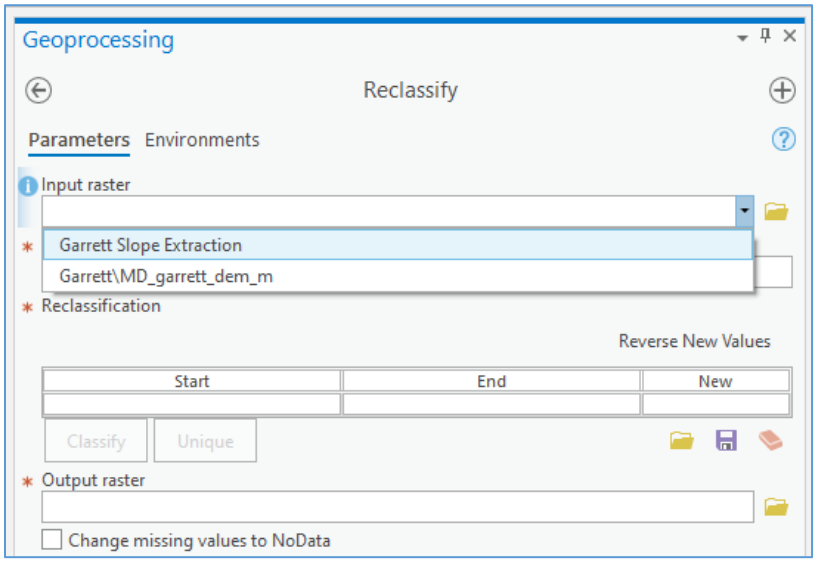
5. Open the Geoprocessing pane by selecting the Analysis tab in the menu bar and clicking the Tools icon.



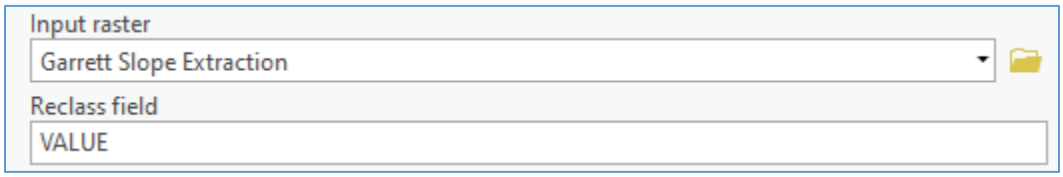
6. Search for the Reclassify tool in the Geoprocessing pane; for this tutorial we will use the Spatial Analyst Tool:



7. Select your input raster from the dropdown



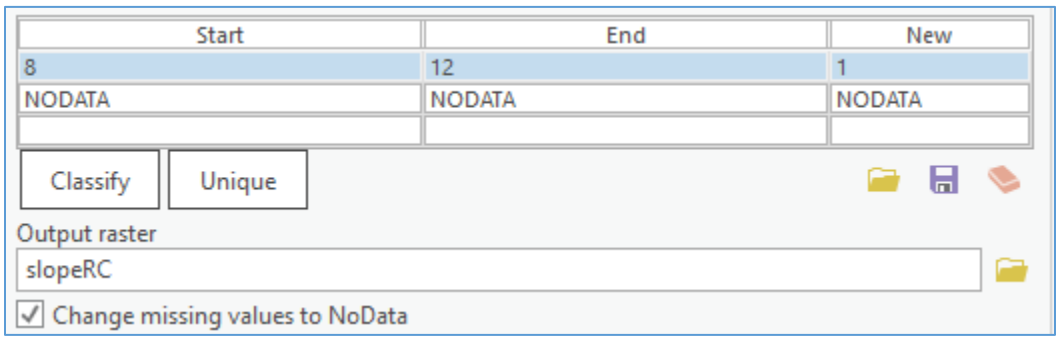
8. Select the Reclass field: VALUE *(when working with topographic LiDAR raster data, 'VALUE' is the default field for cell values)*



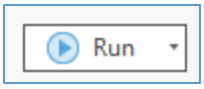
9. For our hypothetical scenario, we want to reclassify slope percentages between 8-12%. We can either reclassify values within our range (8-12) to a single value or reclassify all values outside our range to equal 'NoData'.

   For this example, we will set all values within our range to (1).

10. In the reclassification table, set the Start value to 8, the End value to 12, and the New value to 1. Check the box for Change missing values to NoData and create an appropriate output raster name and workspace.

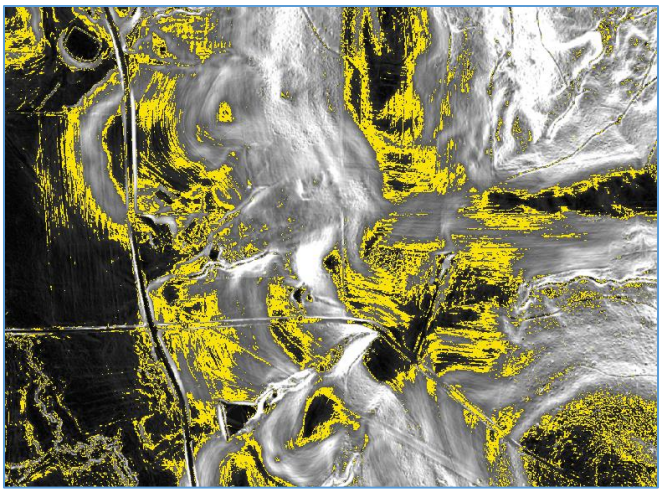


11. Check all input parameters for correctness and hit



12. The cells remaining with a value of 1 are the resulting reclassified cells with a slope value between 8-12%
    (represented by the yellow color in the image below)

13. All other values outside of this range (8-12% slope) are reclassified as NoData and effectively removed from the output.



Reclassify Aspect Data

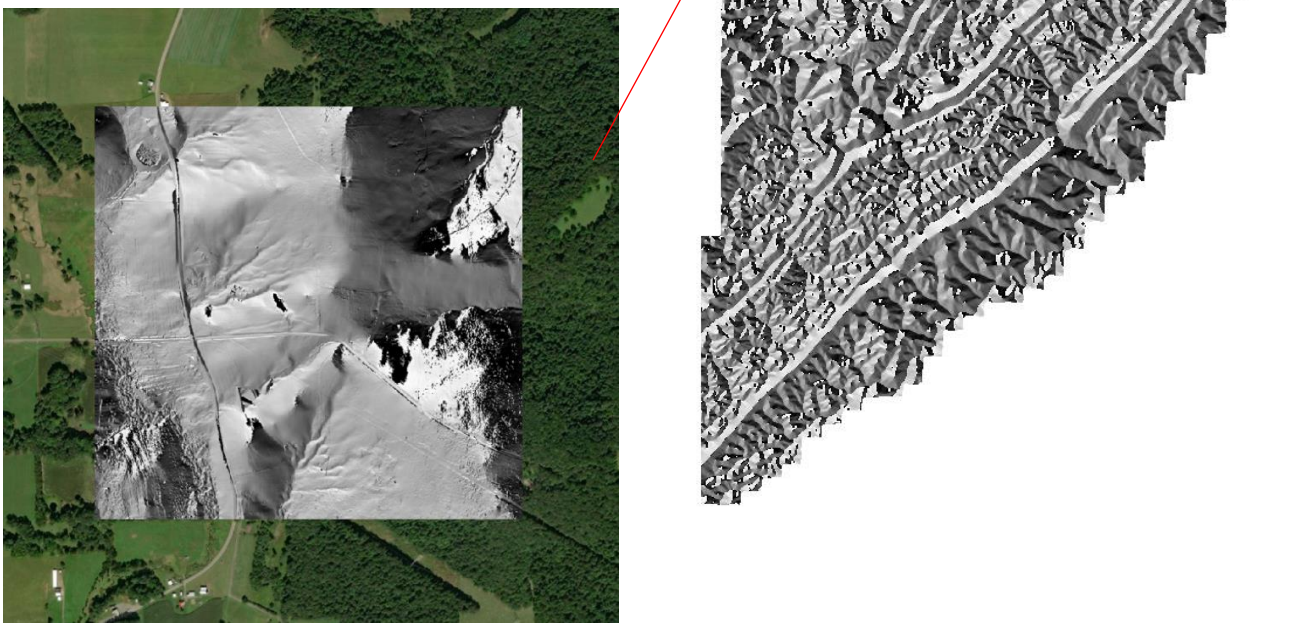
1. Open an existing project, or start a new map template, in ArcGIS Pro.

2. Add the desired Image Service to your map. [Example: Garrett_DEM_M]
   For more information on accessing Maryland LiDAR image services, please read How to Access Maryland LiDAR Image Services.
   Note: Raster functions are only available for the services within the [DEM_M] folder.

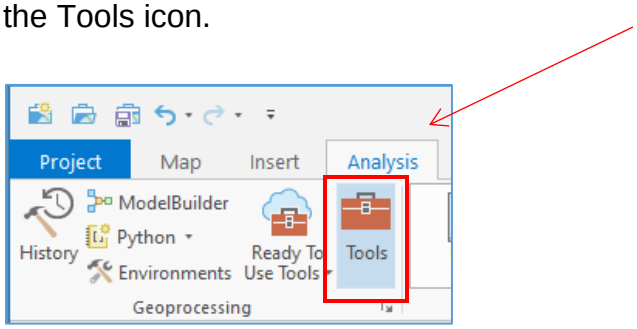
3. Apply the aspect function to Garrett_DEM_m
   For more information on accessing image service functions, please read How to Access Image Service Functions in ArcGIS for Desktop.

4. *For this tutorial we are clipping a region from the NW corner of Garrett County >>>*

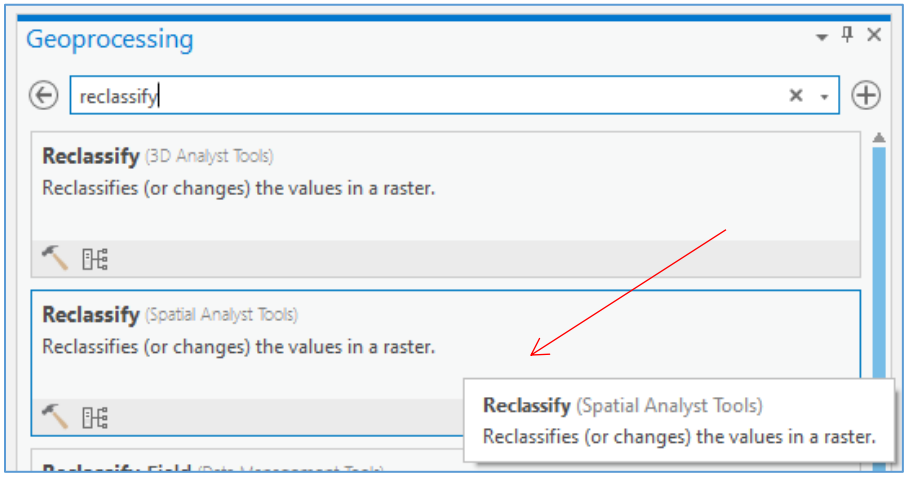
   Extract your AOI (area of interest) from the image service to allow for local data processing. For more information on the image service extraction process, please read How to Extract from Image Services in ArcGIS for Desktop.



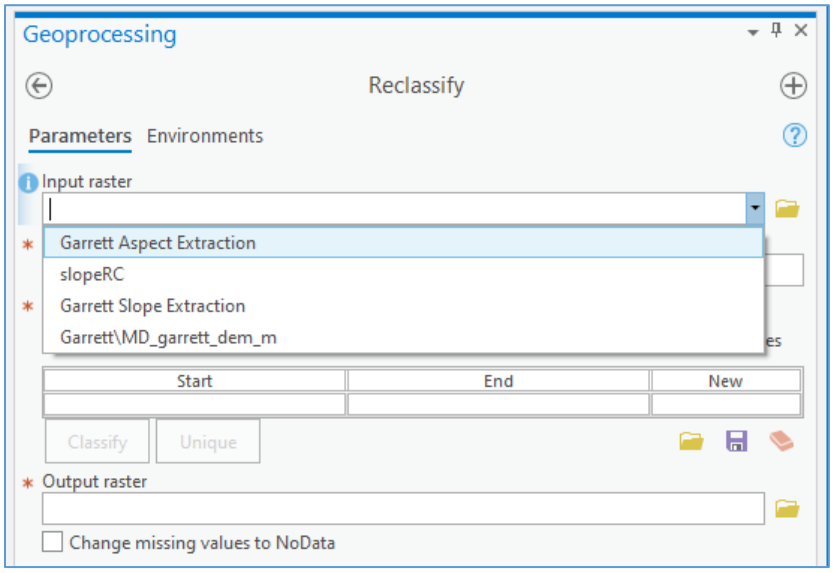
5. Open the Geoprocessing pane by selecting the Analysis tab in the menu bar and clicking the Tools icon.



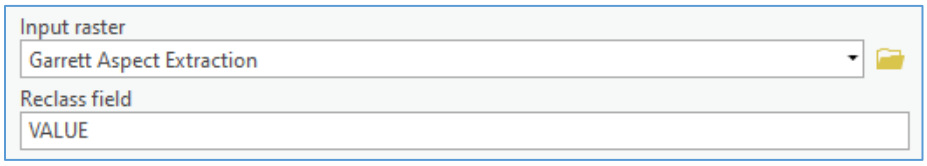
6. Search for the Reclassify tool in the Geoprocessing pane; for this tutorial we will use the Spatial Analyst Tool:



7. Select your input raster from the dropdown



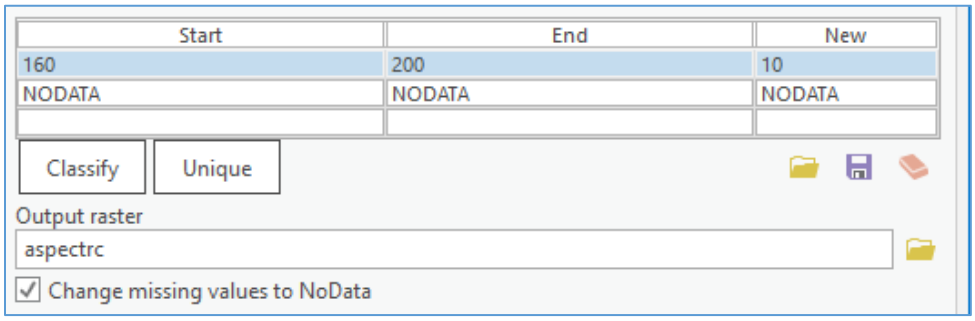
8. Select the Reclass field: VALUE *(when working with topographic LiDAR raster data, 'VALUE' is the default field for cell values)*



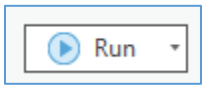
9. For our hypothetical scenario, we want to reclassify aspect between 160-200° (*SSE to SSW face slopes). We can either reclassify values within our range (160-200) to a single value, or reclassify all values outside our range to equal 'NoData'.

   For this example we will set all values within our range to (10).

10. In the reclassification table, set the Start value to 160, the End value to 200, and the New value to 10. Check the box for Change missing values to NoData and create an appropriate output raster name and workspace.

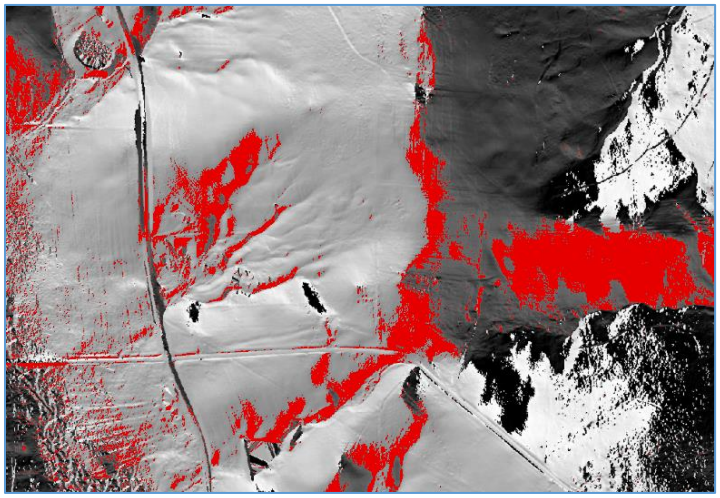


11. Check all input parameters for correctness and hit



12. The cells remaining with a value of 10 are resulting aspect values reclassified from 160-200°.
    (represented by the red colors in the image below)

13. All other values outside of this range (160-200°) are reclassified as NoData and effectively removed from the output.

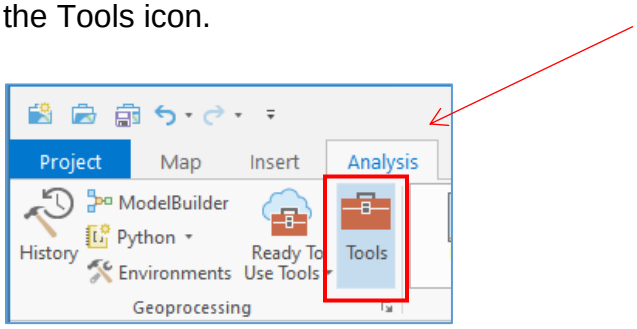


Merge Classifications for Analysis

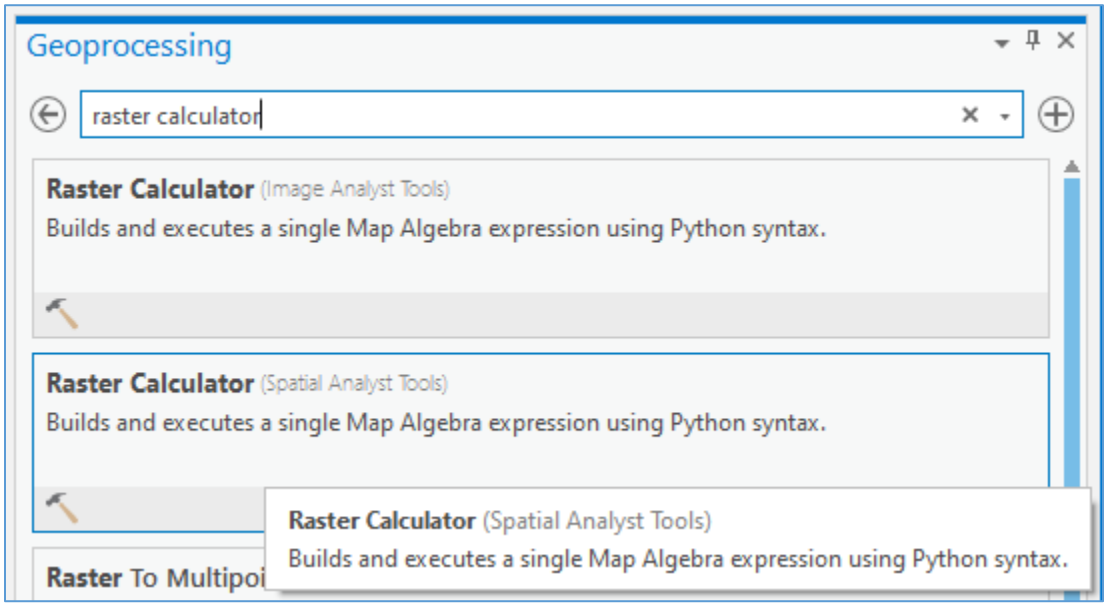
1. Refer to the following sections of this tutorial if they have not yet been completed:
   Reclassify Slope Data
   Reclassify Aspect Data

2. With the slope and aspect reclassifications complete, we can calculate the rasters to return overlapping cells and help identify regions that are moderate grade (8-12% slope) as well as south facing (160-220 azimuth).

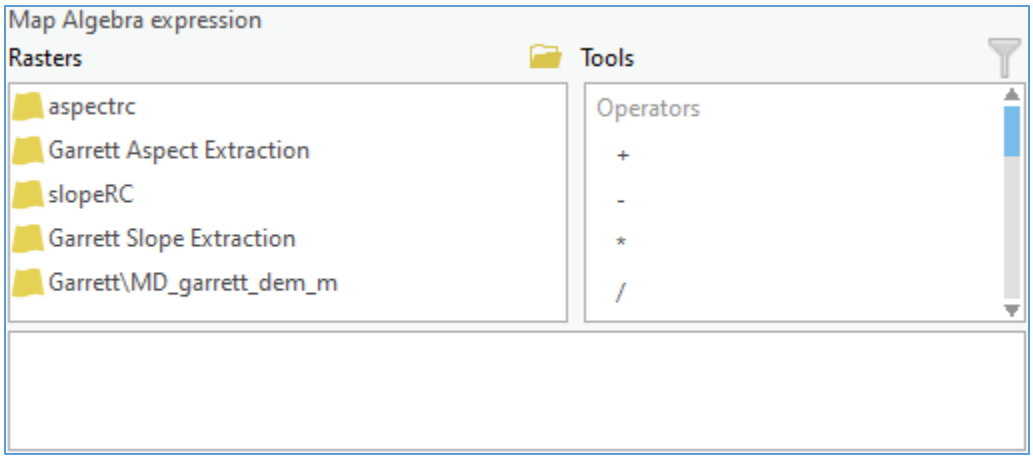
3. Open the Geoprocessing pane by selecting the Analysis tab in the menu bar and clicking the Tools icon.



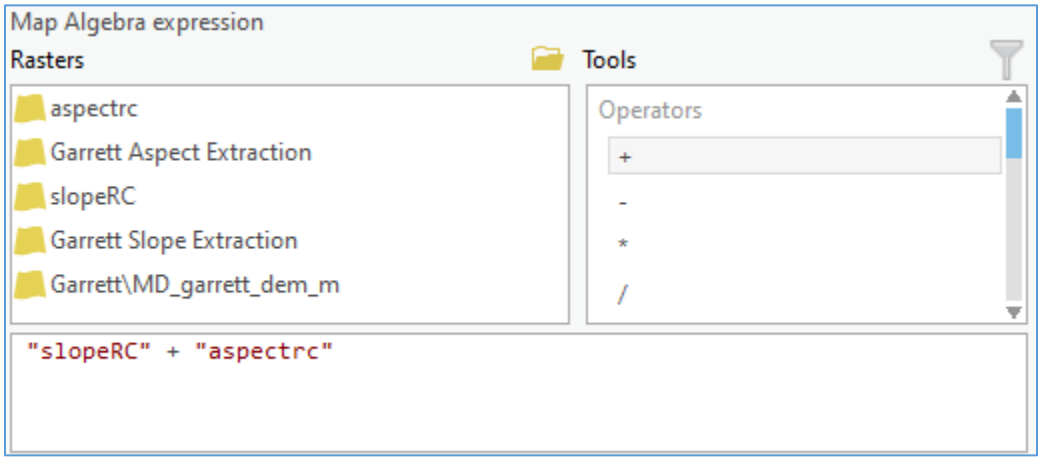
4. Search for Raster Calculator in the Geoprocessing pane. We will be using the Spatial Analyst tool for this tutorial.



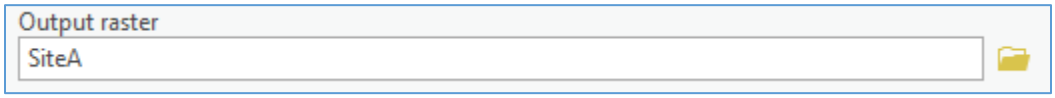
5. Using the Rasters and Tools panels in the Raster Calculator tool, double click the raster layers to add to the expression, using operators where appropriate.



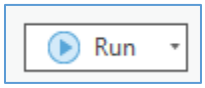
6. In this example, using map algebra we can effectively intersect the two raster layers by adding them together. Double click the reclassified slope layer (slopeRC) double click the + operator, then double click the reclassified aspect layer (aspectRC) to complete the expression:



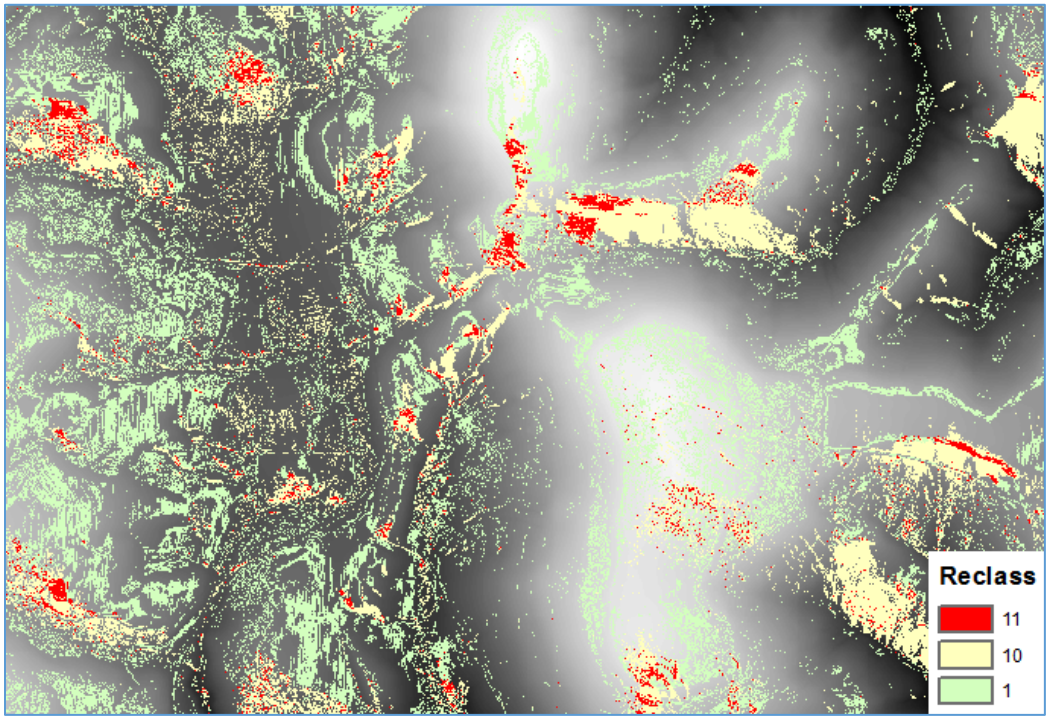
7. Set an appropriate output raster.



8. Double check input parameters for correctness and click



9. In the screen shot below, you will notice three different reclassifications:
   Cells with a value of 1 are slopes reclassified within 8-12% rise.
   Cells with a value of 10 are azimuth reclassified between 160-200°.
   Cells with a value of 11 are all south facing graded slopes. *(where reclassified slopes of 8-12% rise and aspect facing 160-200° are merged with a map algebra equation)*



Method 2: Using ArcGIS Pro Raster Functions

This method uses Raster Functions in ArcGIS Pro. Processing is done on-the-fly and creates temporary layers in the map as you work; selecting only the desired outputs for exporting. This method can save the user a considerable amount of time when processing local raster data.

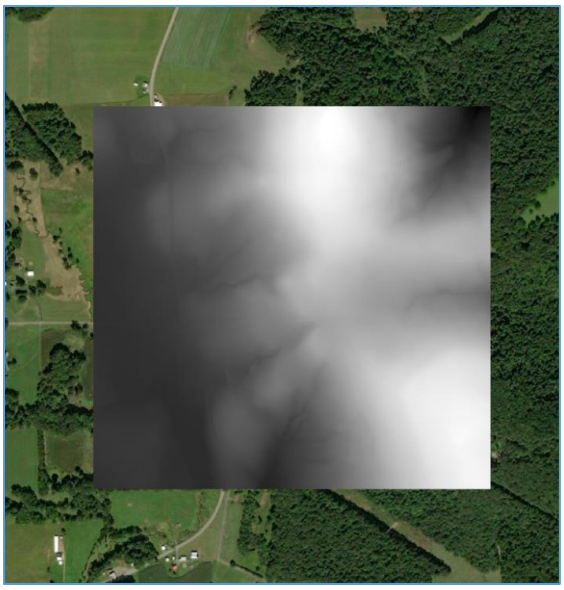
Generate Slope and Aspect

1. Open an existing project, or start a new map template, in ArcGIS Pro.

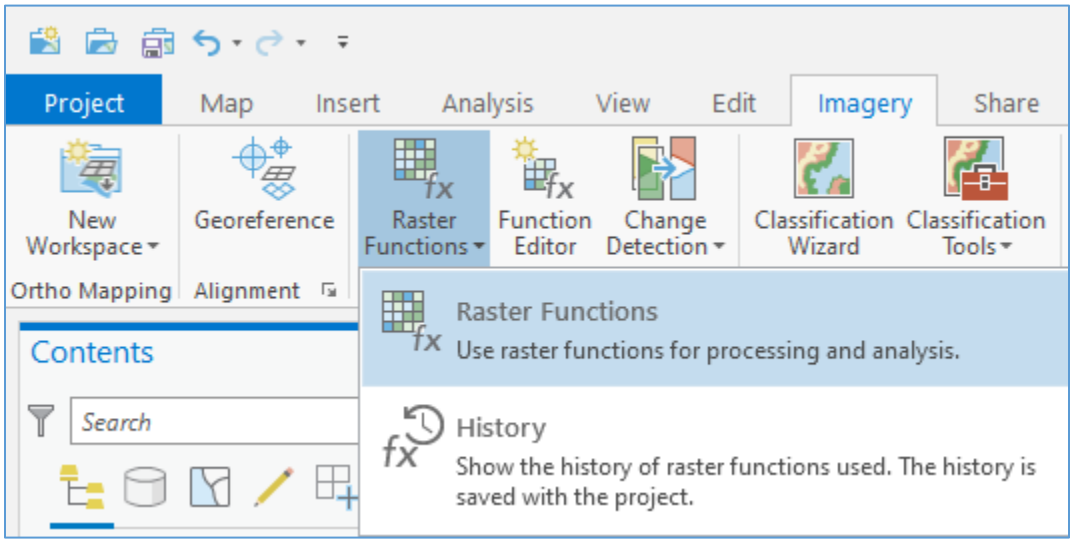
2. Add the desired Image Service to your map. [Example: Garrett_DEM_M]
   For more information on accessing Maryland LiDAR image services, please read How to Access Maryland LiDAR Image Services.
   Note: Raster functions are only available for the services within the [DEM_M] folder.

3. *For this tutorial we are clipping a region from the NW corner of Garrett County >>>*

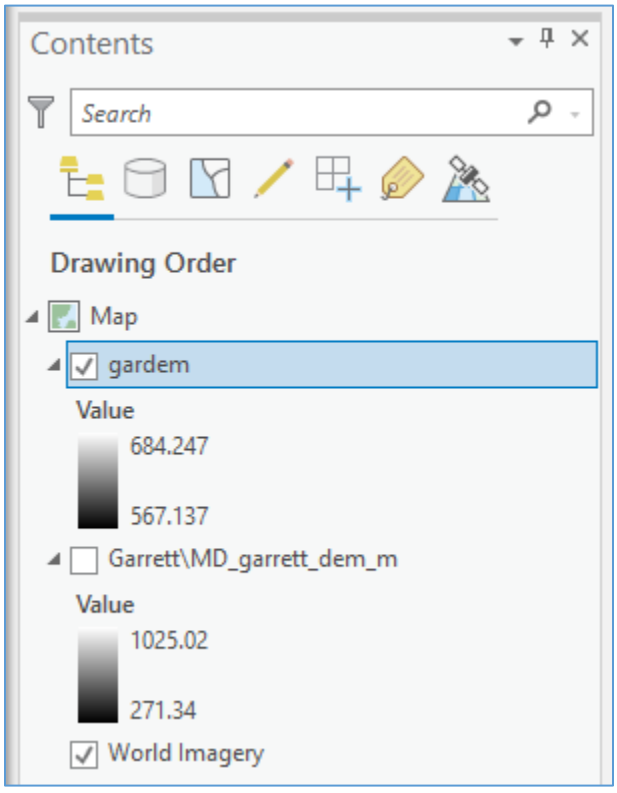
   Extract your AOI (area of interest) from the DEM image service to allow for local data processing. For more information on the image service extraction process, please read How to Extract from Image Services in ArcGIS for Desktop.



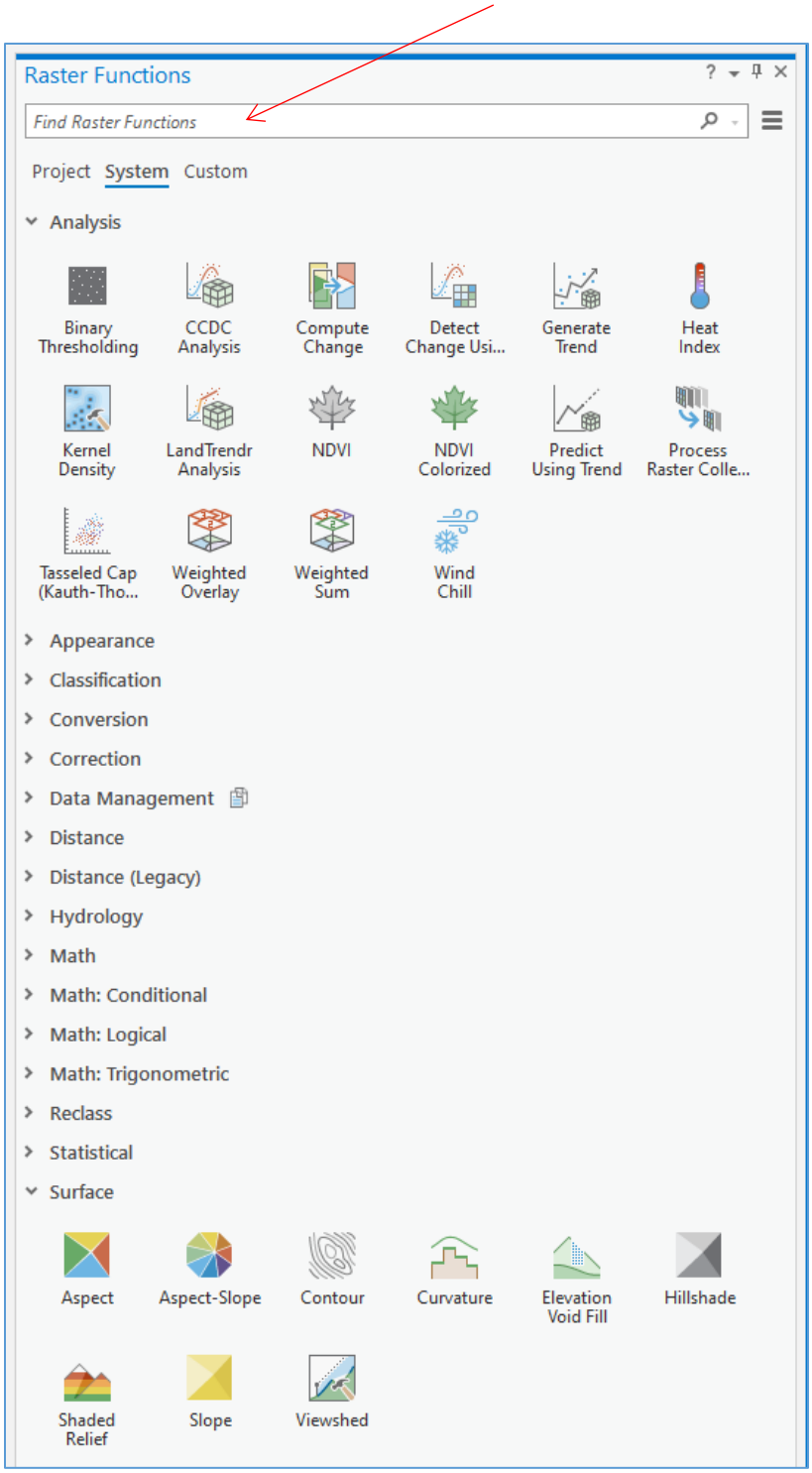
4. Under the Imagery tab in the menu bar, select Raster Functions



5. Single click your raster dataset in the Contents pane to ensure you are applying the raster function to the appropriate layer:

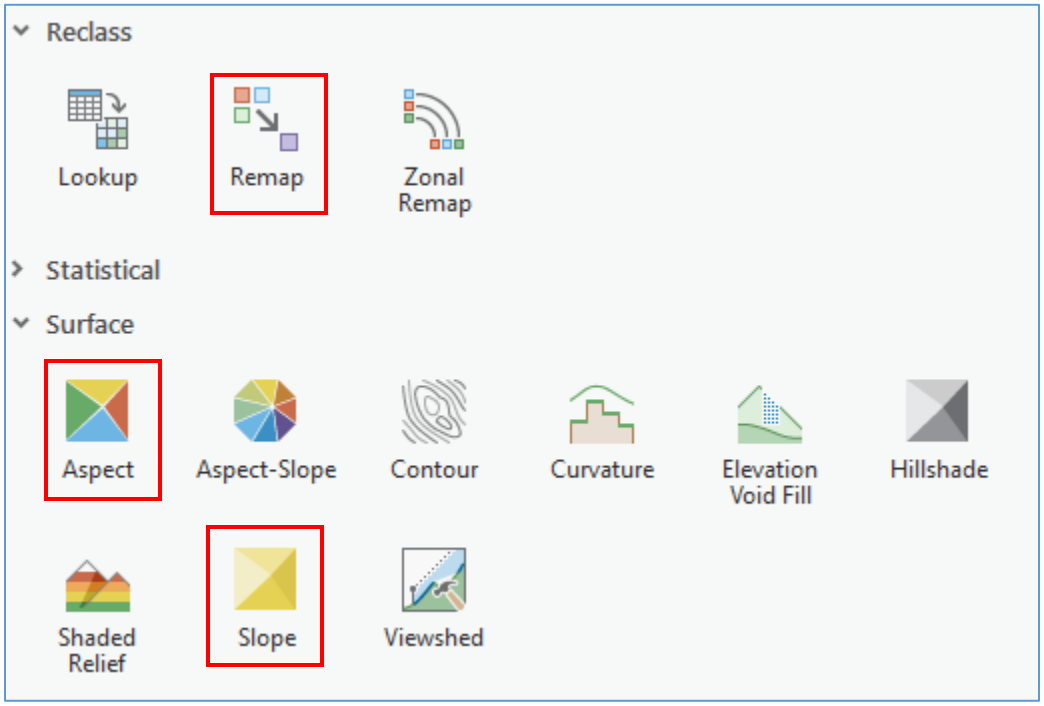


6. The Raster Functions in ArcGIS Pro offer a wide range of analysis and processing tools to apply on the fly within your map. Explore the system functions offered by expanding the appropriate sections, or simply search by typing in your desired function in the Find Raster Functions search bar:

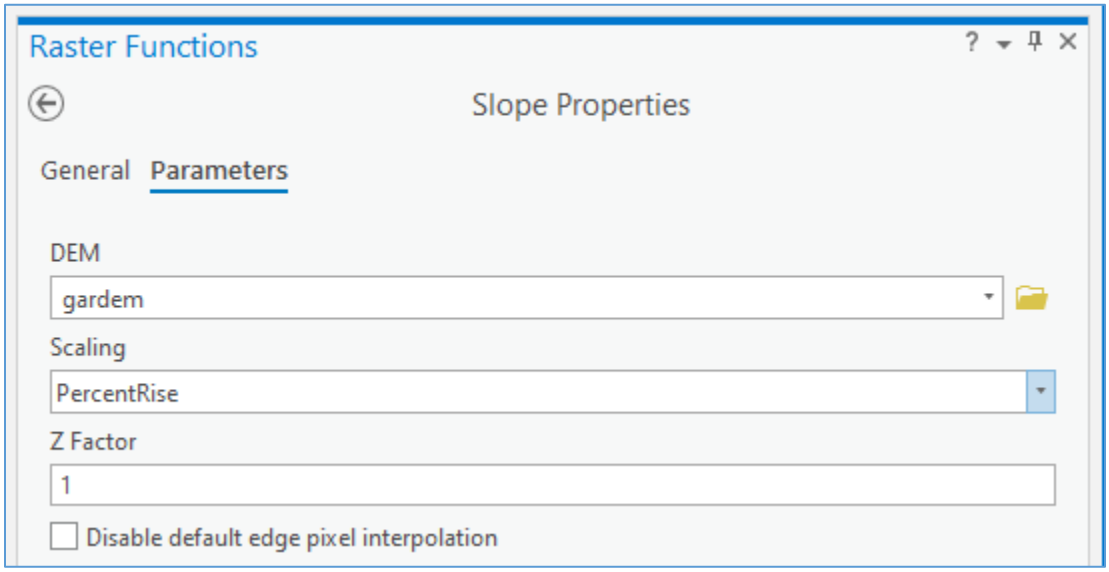


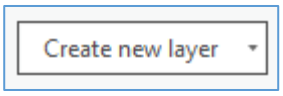
7. In this tutorial, we will be using the following raster functions, in this order:

   Surface >>> Slope
   Surface >>> Aspect
   Reclass >>> Remap

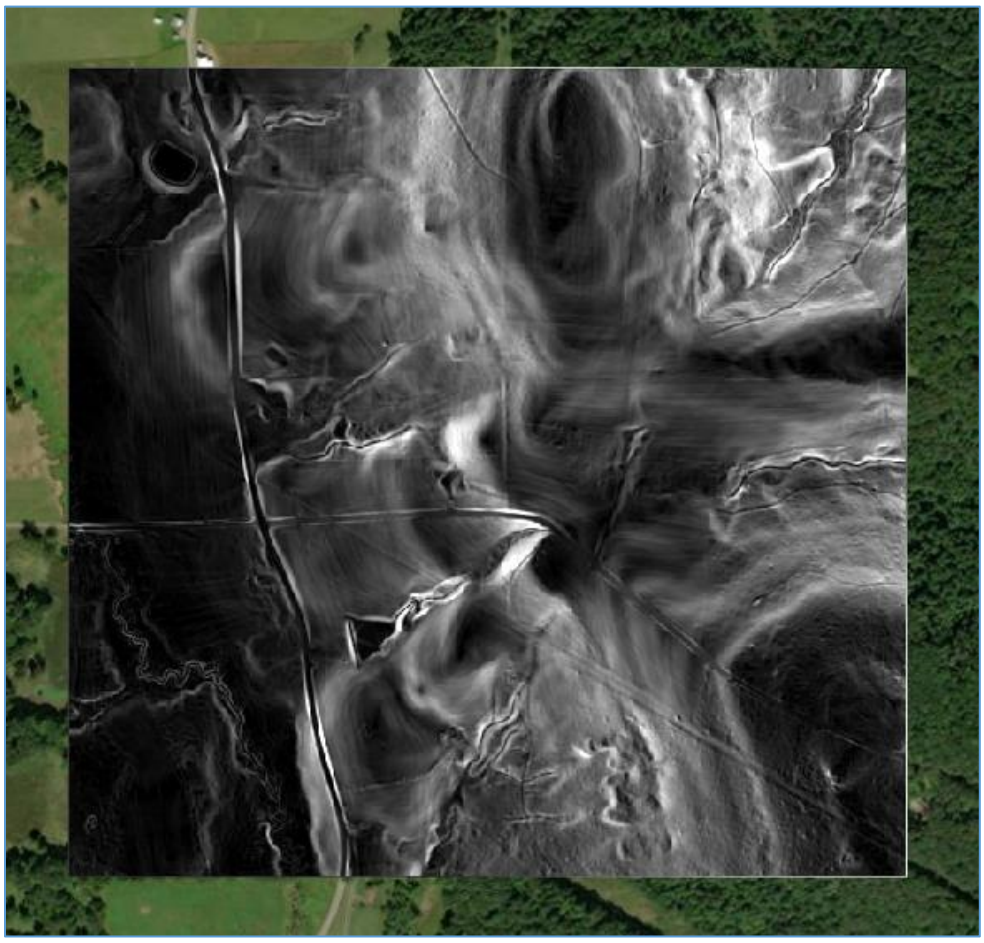


8. Start with the Slope function. Select the appropriate DEM for the input. Change the Scaling to PercentRise:



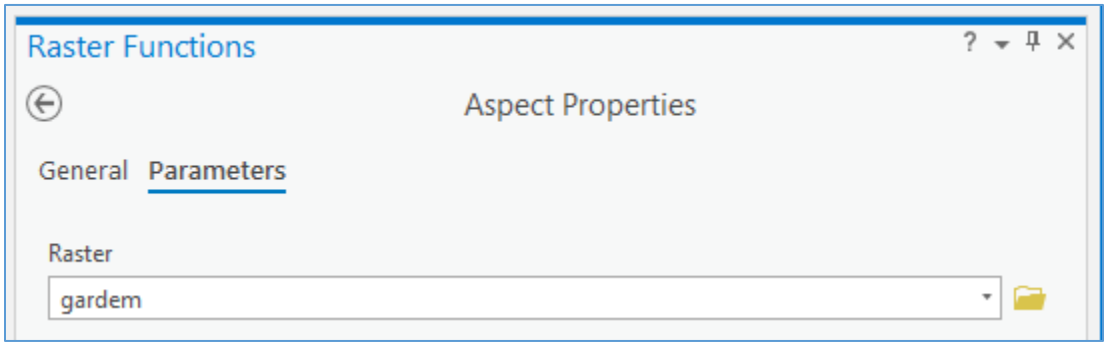
9. Click 

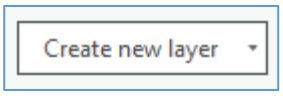
to add the function output to the map



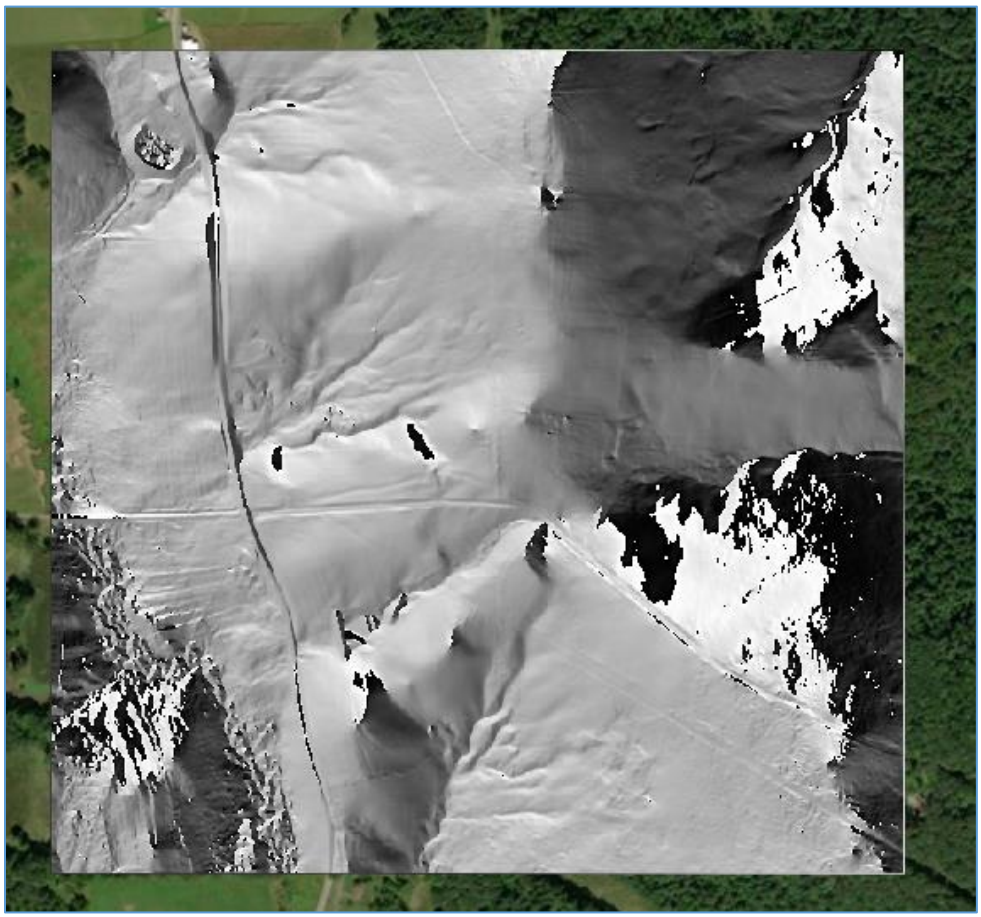
10. Return to the raster functions pane and select Aspect.

11. Ensure the correct Raster input (DEM) is being selected here and not the previously processed Slope layer



12. Click 

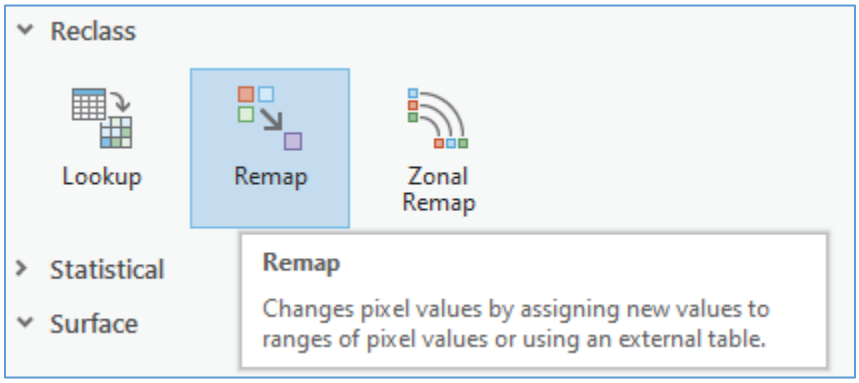
to add the function output to the map



Continue to the next section to reclassify Slope and Aspect using the Remap raster function.

Reclassify Slope and Aspect

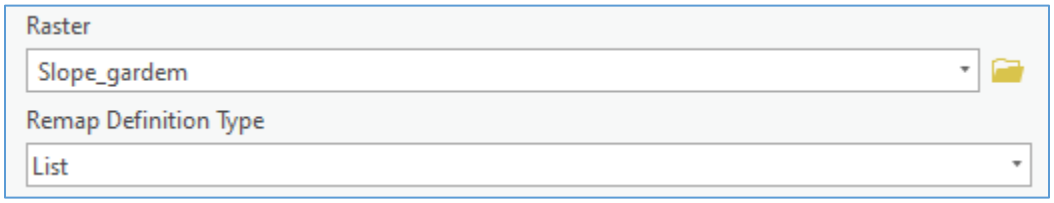
1. Continuing from the previous section, select the Remap raster function from the list.



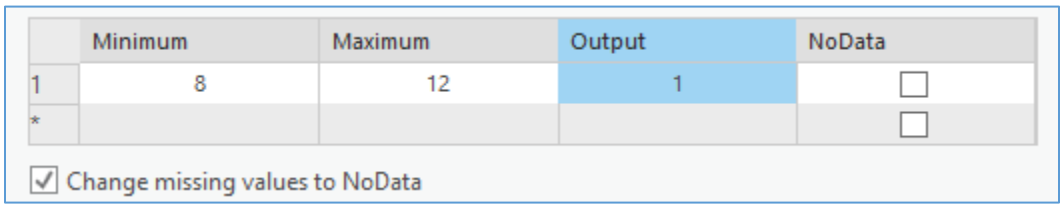
2. For our hypothetical scenario, we want to reclassify slope values between 8-12% rise. We can either reclassify values within our range (8-12) to a single value, or reclassify all values outside our range to equal 'NoData'.

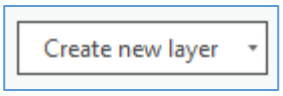
   For this example we will set all values within our range (8-12) to a value of 1.

3. Select the appropriate input Raster (in this case Slope) and select List for the Remap Definition Type:

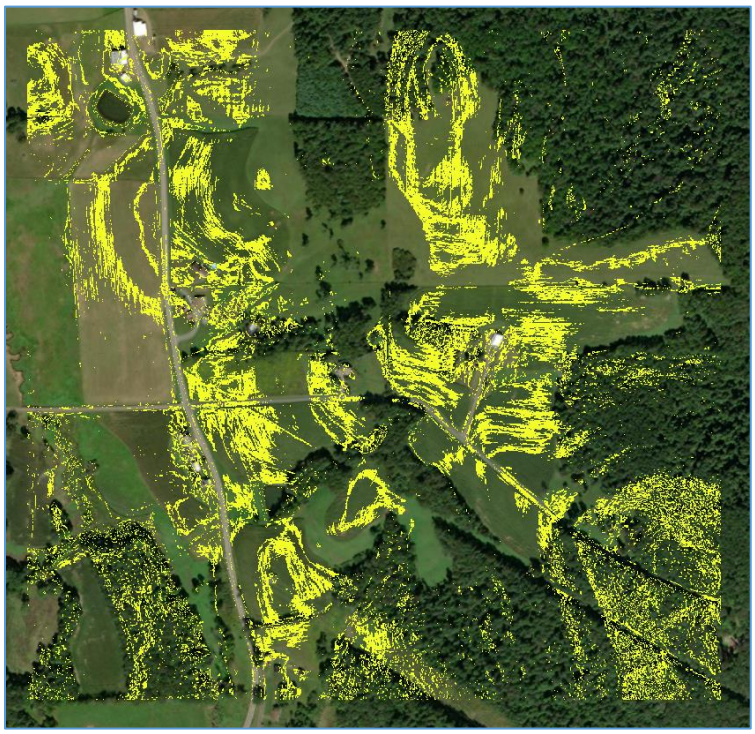


4. Minimum is set to 8, Maximum is set to 12, and Output is set to 1. Check the box to change missing values to NoData:

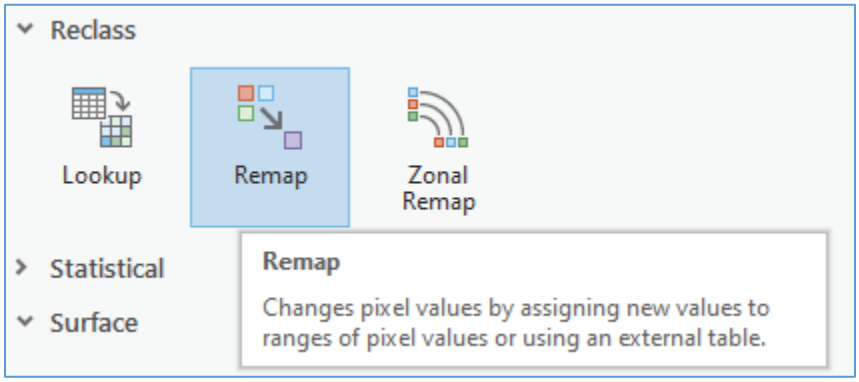


5. Click 

to add the function output to the map



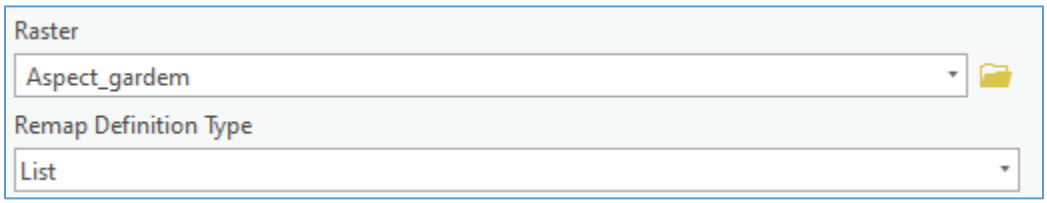
6. Repeat this process for the Aspect layer. Select Remap in the Raster Function list:



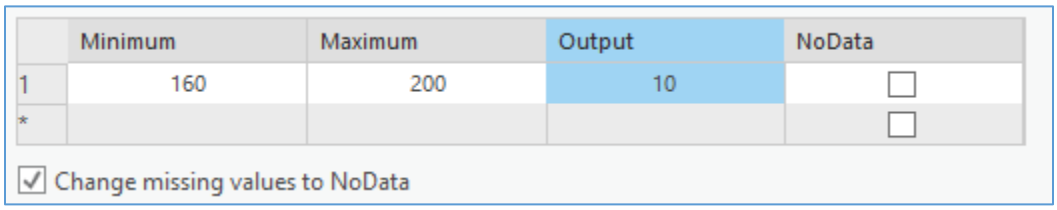
7. For our hypothetical scenario, we want to reclassify aspect values between 160-200°. We can either reclassify values within our range (160-200) to a single value, or reclassify all values outside our range to equal 'NoData'.

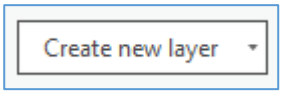
   For this example we will set all values within our range (160-200) to a value of 10.

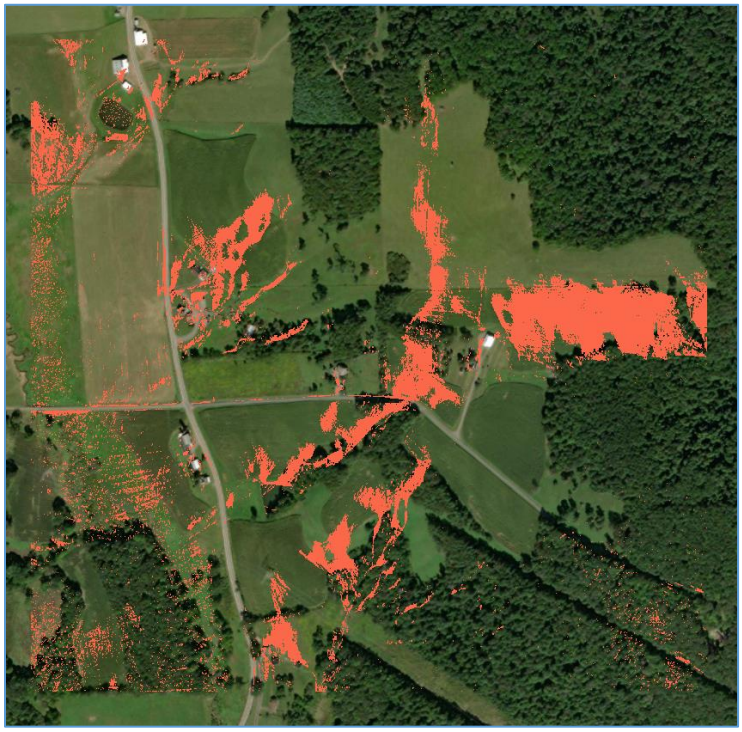
8. Select the appropriate input Raster (in this case Aspect) and select List for the Remap Definition Type:



9. Minimum is set to 160, Maximum is set to 200, and Output is set to 10. Check the box to change missing values to NoData:



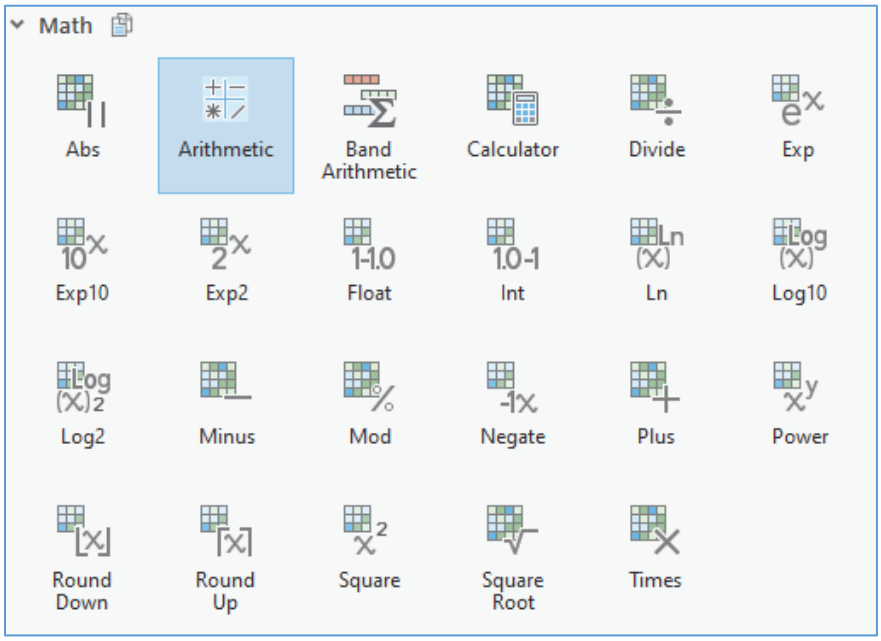
10. Click  to add the function output to the map



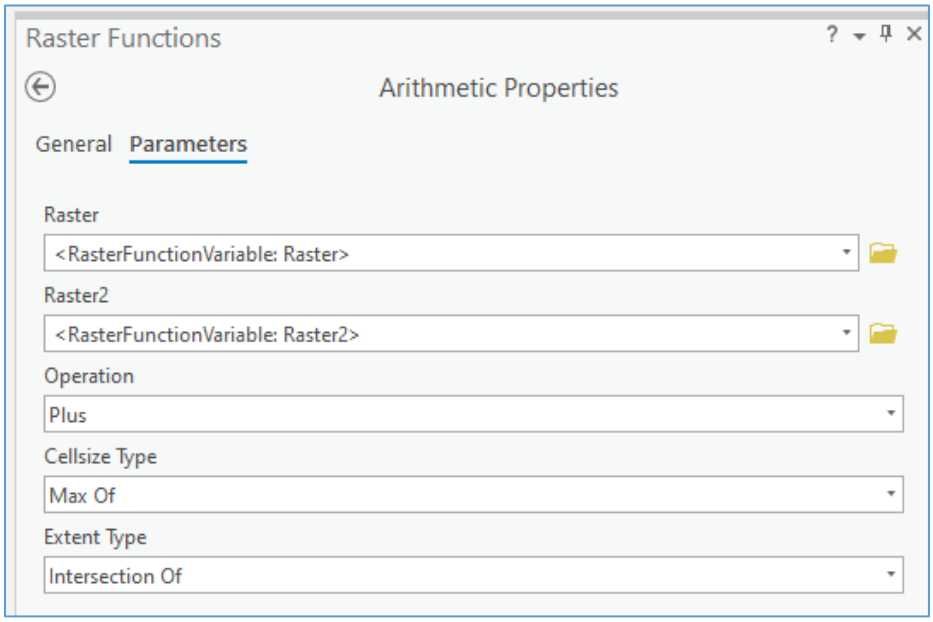
Continue to the next section to merge the reclassified layers.

Merge Classifications for Analysis

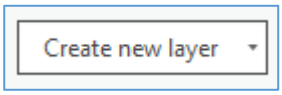
1. Continuing from the previous section, we can merge the two raster layers using Map Algebra. There are multiple approaches to conducting this algebraic function; in this tutorial we will be using the Arithmetic raster function in ArcGIS Pro. Open the Raster Functions pane and search for Arithmetic or find the function under the Math section of the list:



2. The function parameters will ask for two raster inputs and an operation, which defaults to Plus.

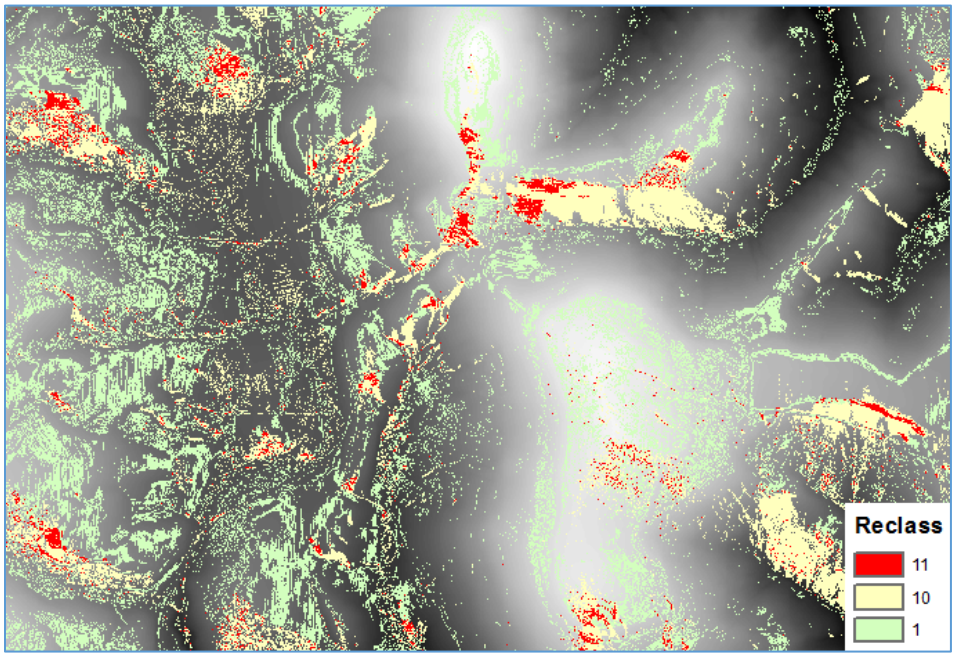


3. Input the Slope and Aspect remap layers for the two raster inputs (the order does not matter here when using the addition operation), and leave the operation as Plus:

4. Click 

to add the function output to the map

5. In the screen shot below, you will notice three different reclassifications:
   Cells with a value of 1 are slopes reclassified within 8-12% rise.
   Cells with a value of 10 are azimuth reclassified between 160-200°.
   Cells with a value of 11 are all south facing graded slopes. *(where reclassified slopes of 8-12% rise and aspect facing 160-200° are merged with a map algebra equation)*



Continue to the next section to learn about complex function chains in the Function Editor

Function Editor – Complex Function Chains

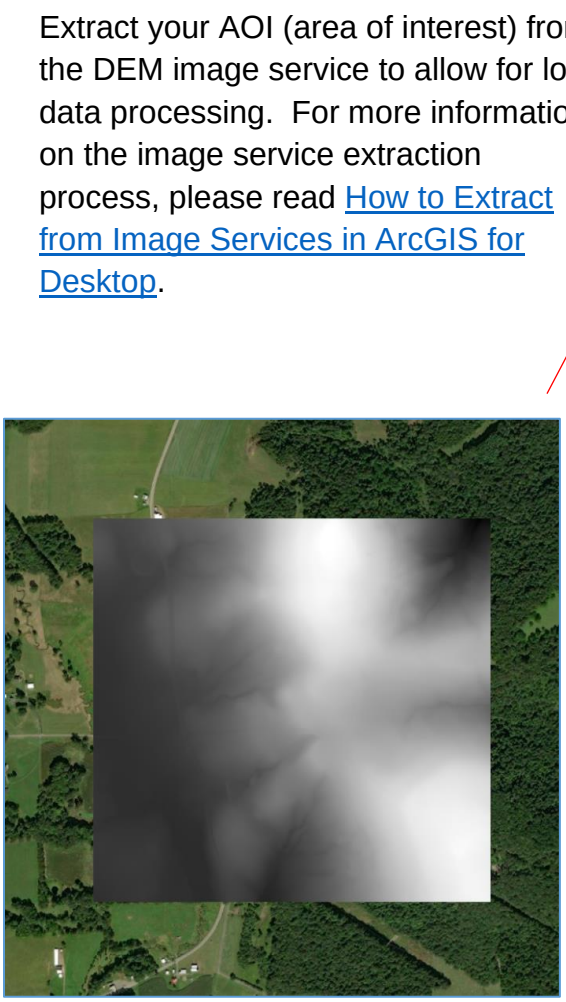
ArcGIS Pro brings a new tool called the Function Editor. This is a visual programming language, similar to Model Builder, used specifically for building imagery and raster analysis workflows.

1. Open an existing project, or start a new map template, in ArcGIS Pro.

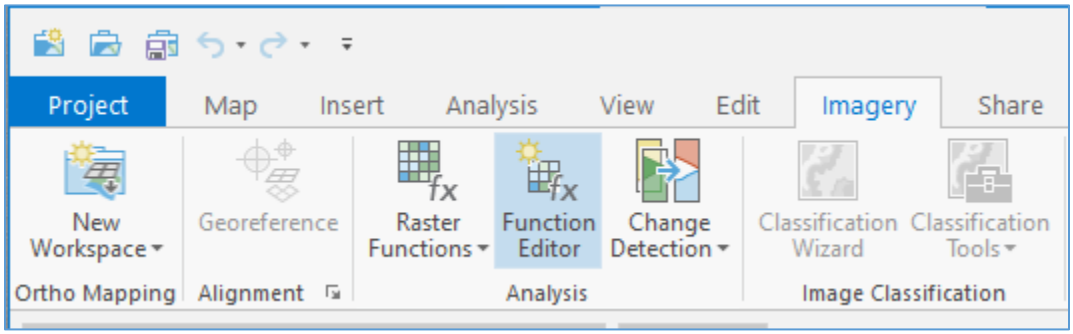
2. Add the desired Image Service to your map. [Example: Garrett_DEM_M]
   For more information on accessing Maryland LiDAR image services, please read How to Access Maryland LiDAR Image Services.
   Note: Raster functions are only available for the services within the [DEM_M] folder.

3. *For this tutorial we are clipping a region from the NW corner of Garrett County >>>*

   Extract your AOI (area of interest) from the DEM image service to allow for local data processing. For more information on the image service extraction process, please read How to Extract from Image Services in ArcGIS for Desktop.

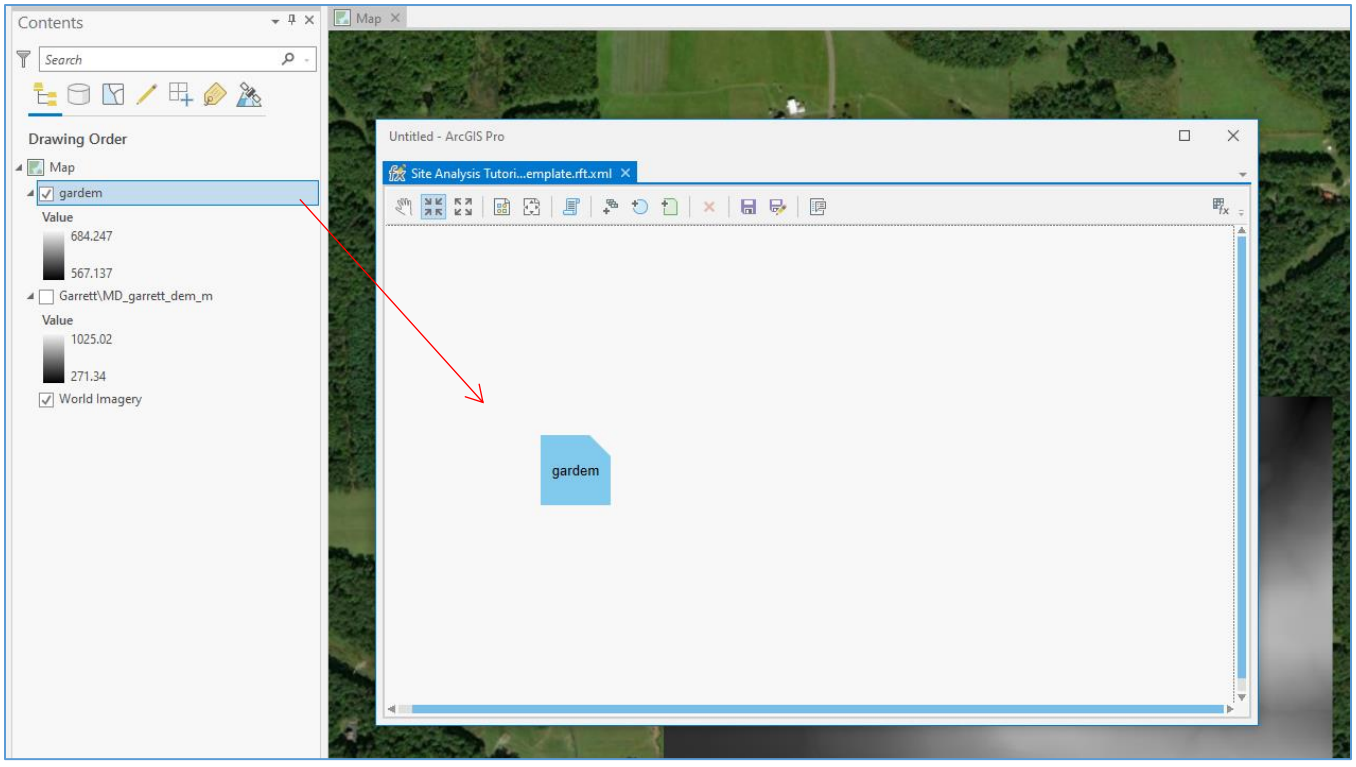


4. Under the Imagery tab on the Menu bar, select Function Editor:

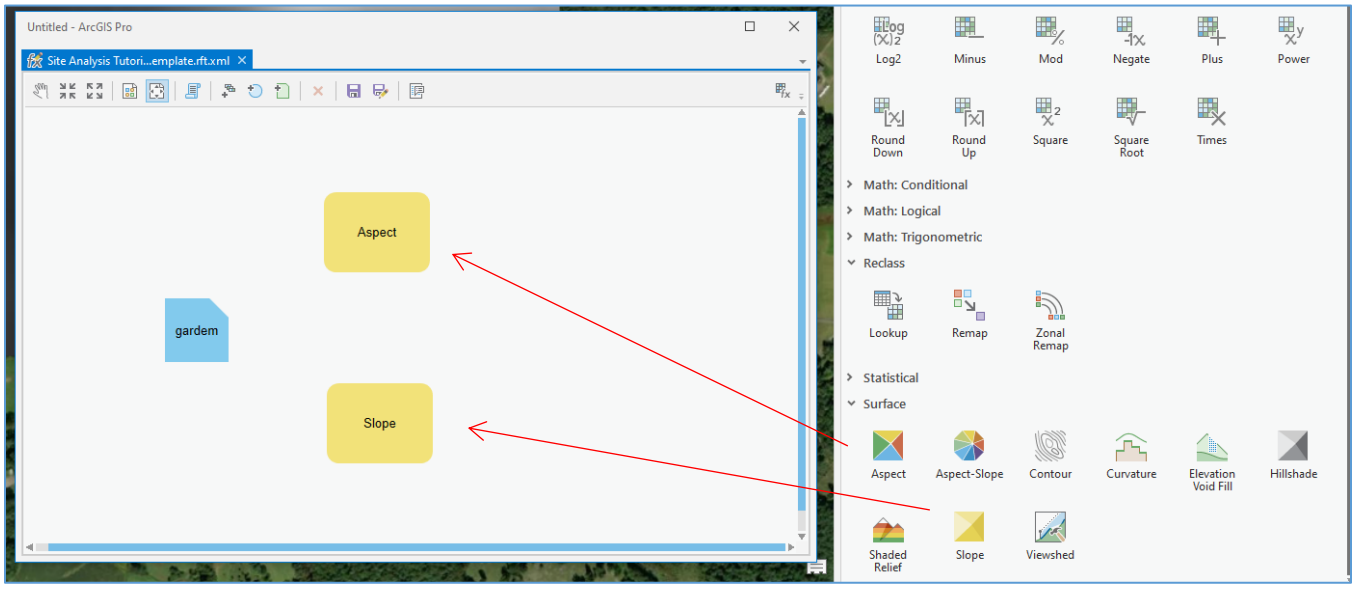


5. A template editor window will open. On the top right, click the Raster Functions icon  to open the list of available system functions. In this window, you will add raster layers to manipulate and raster functions to chain together into a custom raster function template which may be saved and applied to your project as desired.

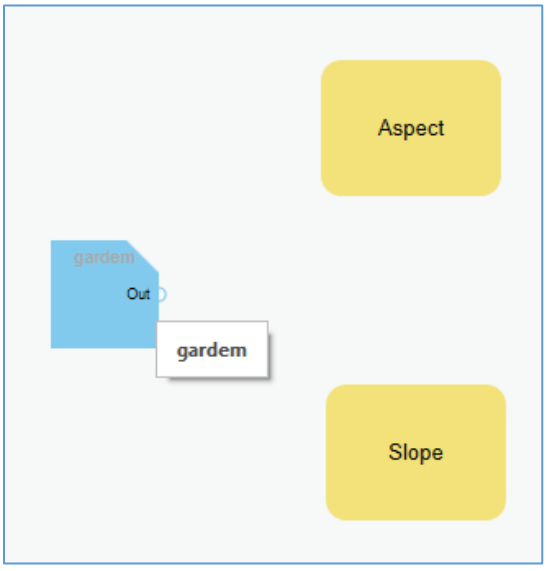
6. Drag and drop the DEM from the Contents pane into the function template editor window:

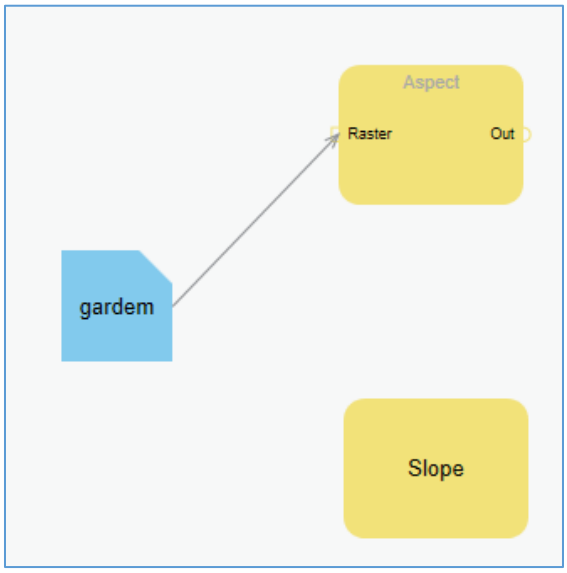


7. From the Raster Functions pane, drag and drop the Slope and Aspect functions into the function template editor window:

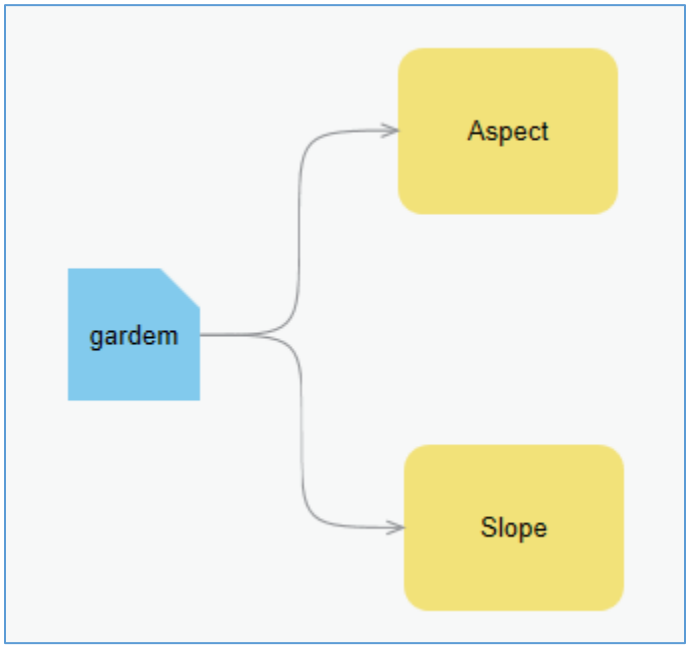


8. Hover towards the right side of the raster layer in the function editor window. Text “Out” should appear; click and drag from the “Out” text into the “Raster” text of one of the function elements to connect the chain:

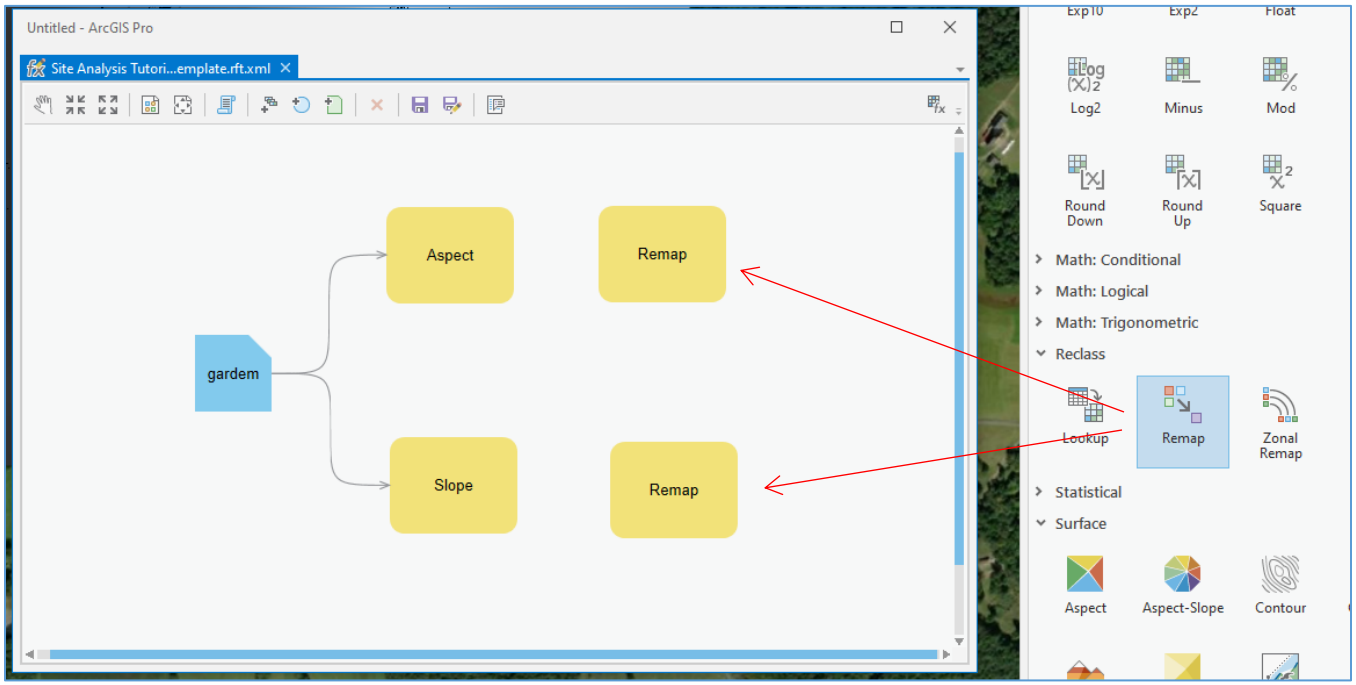




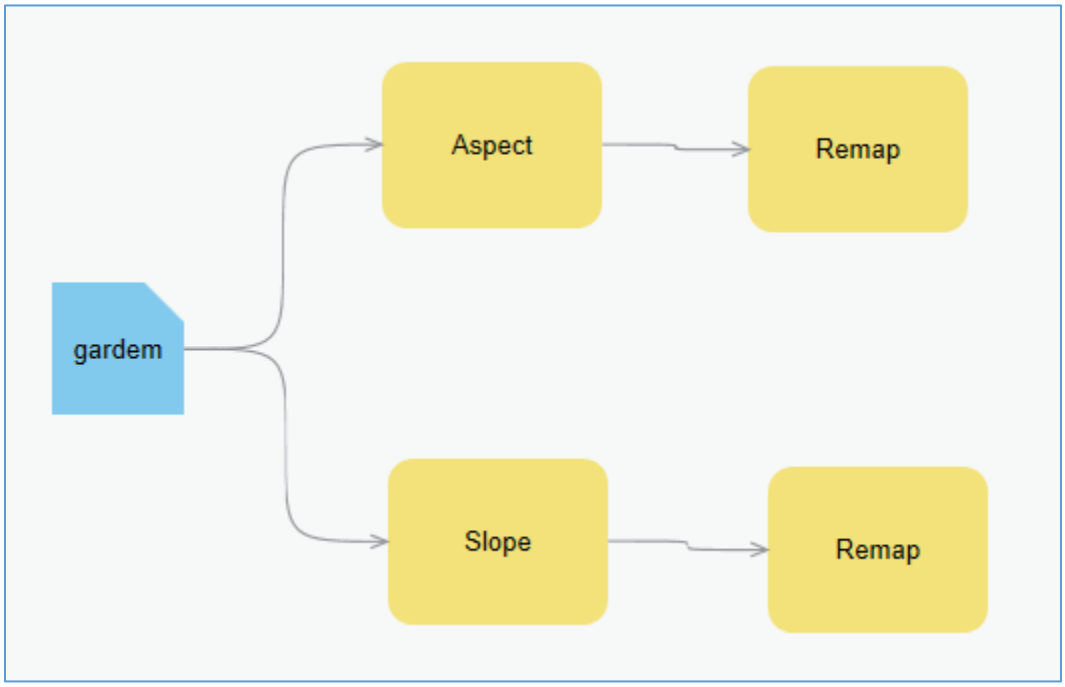
9. Repeat the step for connecting DEM to Slope. The connected chain should look like this, indicating that the DEM will pass an input to two functions simultaneously:



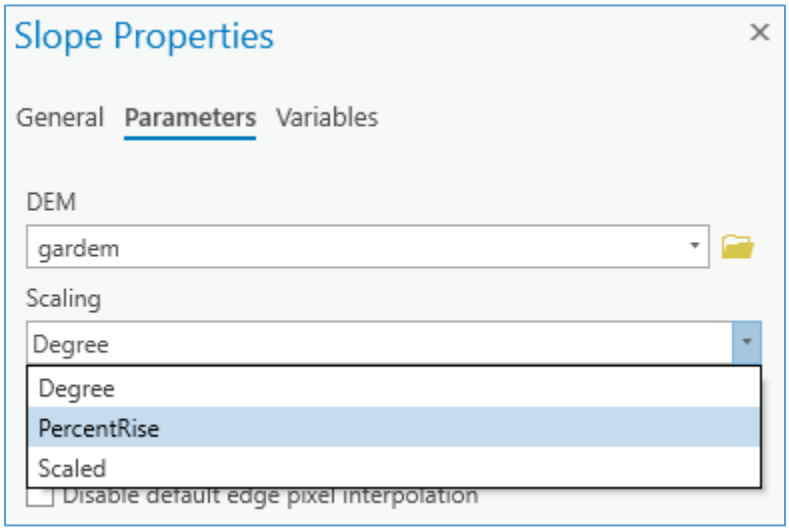
10. Drag two Remap function elements from the Raster Functions pane into the editor window:



11. Connect the function chain from Aspect to Remap, and Slope to Remap, as seen below:



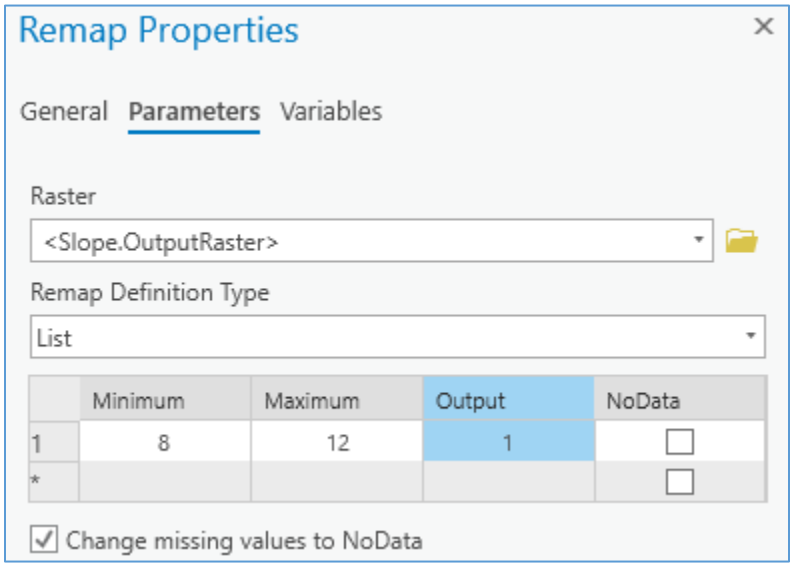
12. Double click Slope element to set the properties Scaling to PercentRise:



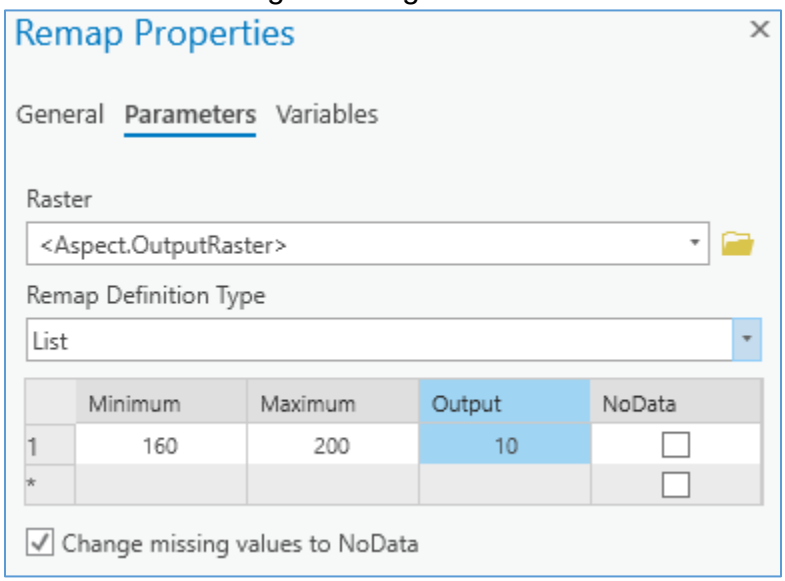
13. Double click Remap elements to set the reclassification list parameters for each function:

Slope: 8 – 12%
Aspect: 160 – 200°

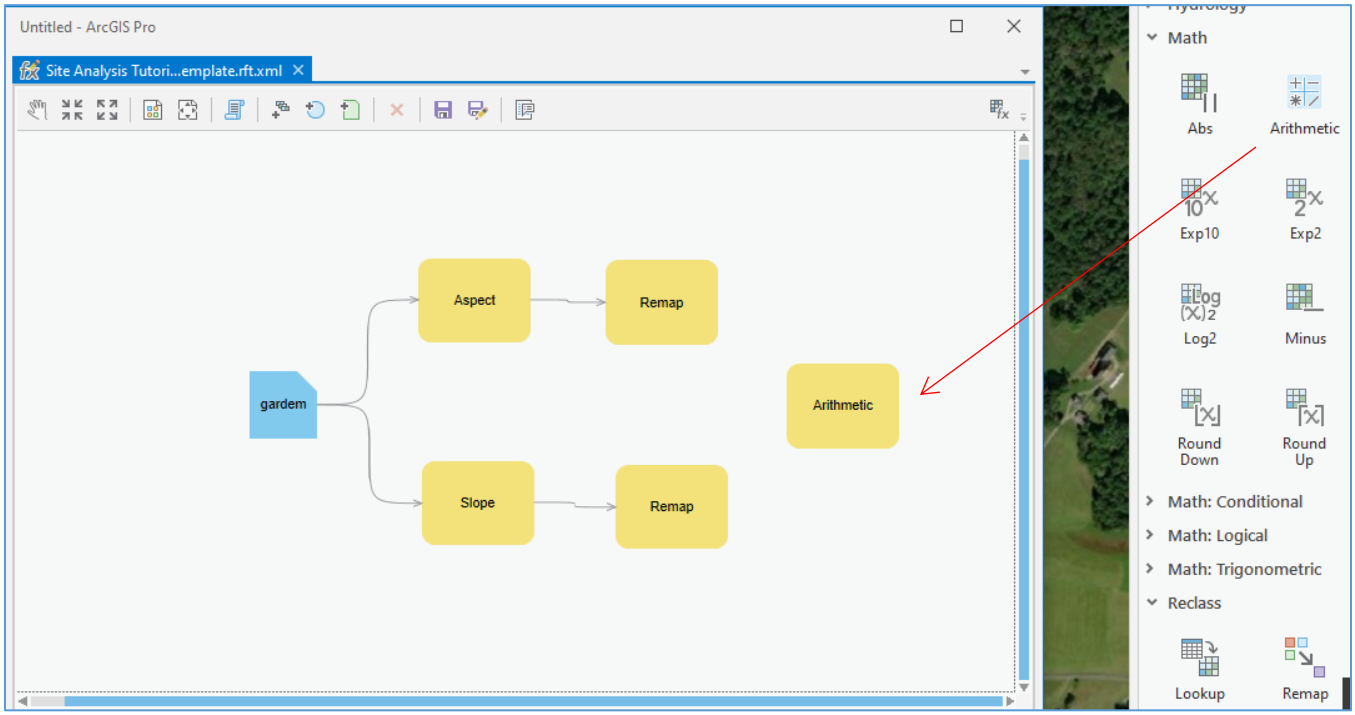
Slope Remap Parameters:
Minimum 8
Maximum 12
Output 1
Check box to change missing values to NoData



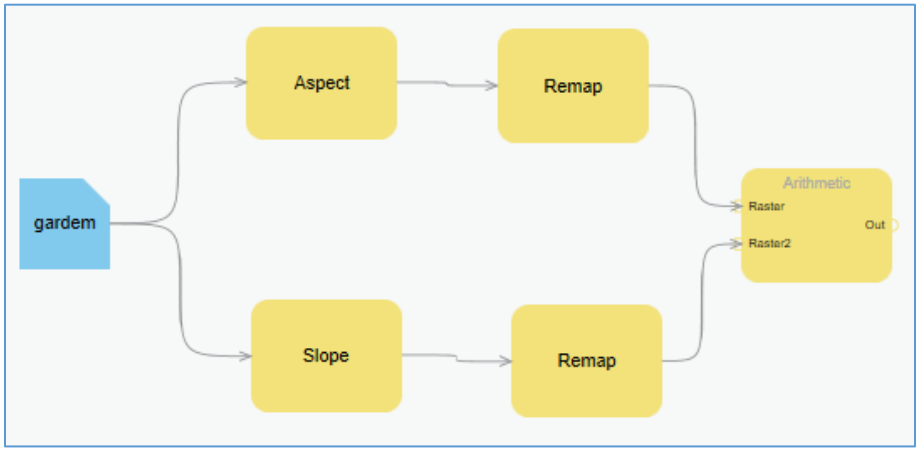
Aspect Remap parameters:
Minimum 160
Maximum 200
Output 10
Check box to change missing values to NoData



14. To complete the function chain for this tutorial, add the Arithmetic function into the editor window to apply Map Algebra to our function chain:

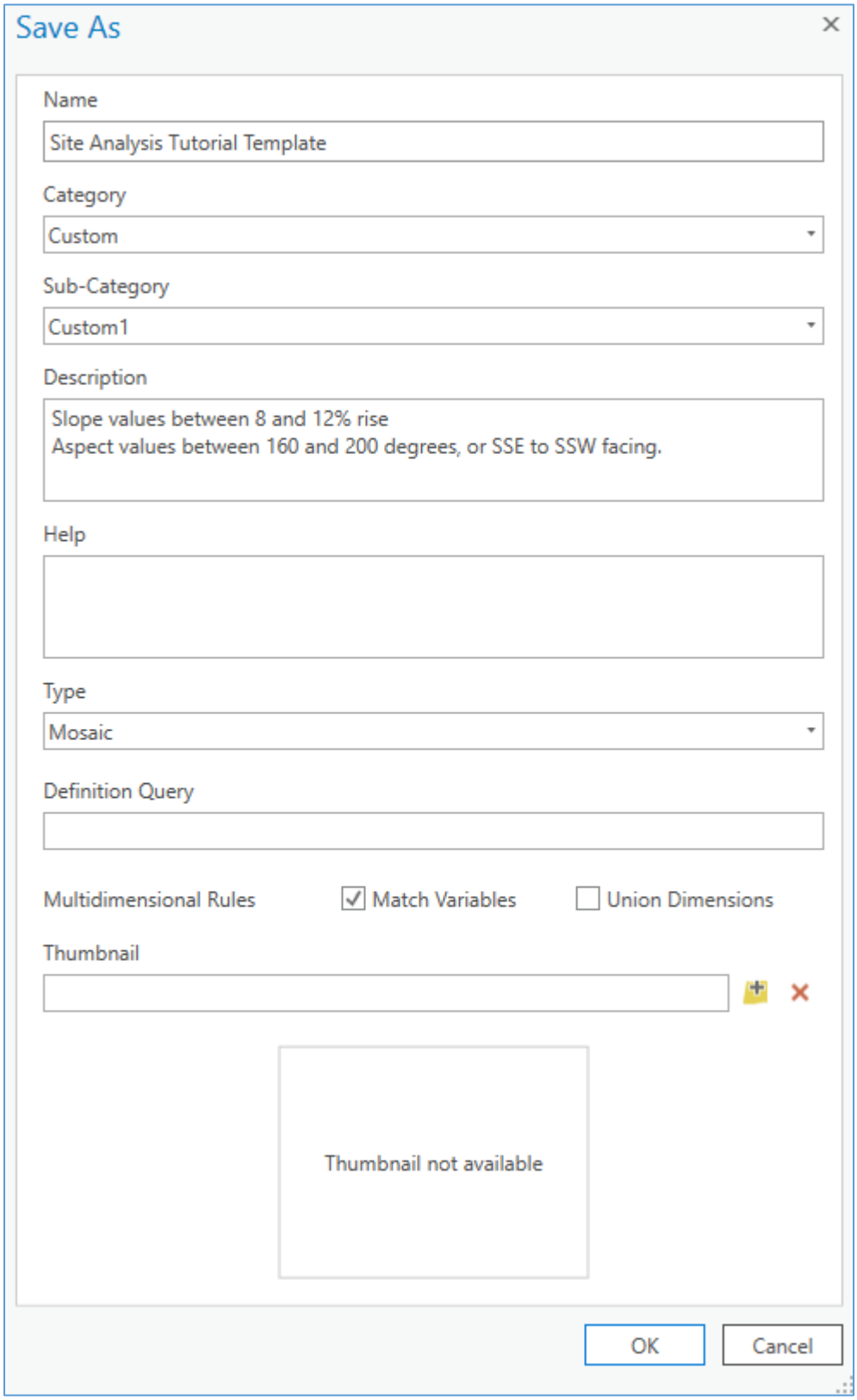


15. Complete the function chain by connecting the Remap elements to Raster 1 and Raster 2 of the Arithmetic function:

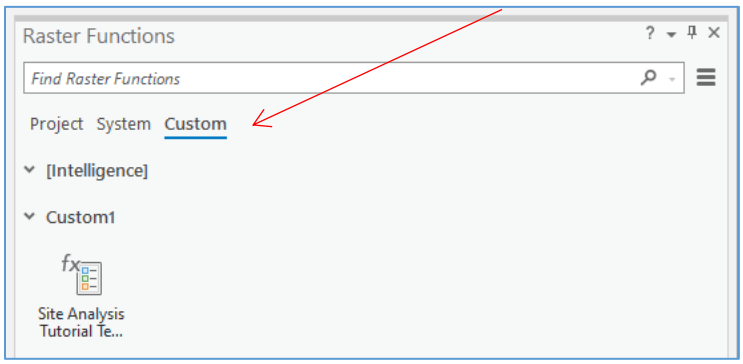


16. The arithmetic function uses a Plus operations by default, so for this tutorial nothing else is needed. However, user should double click each function chain element to open properties and check all parameters before continuing.

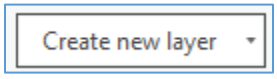
17. Save your customer raster function template:

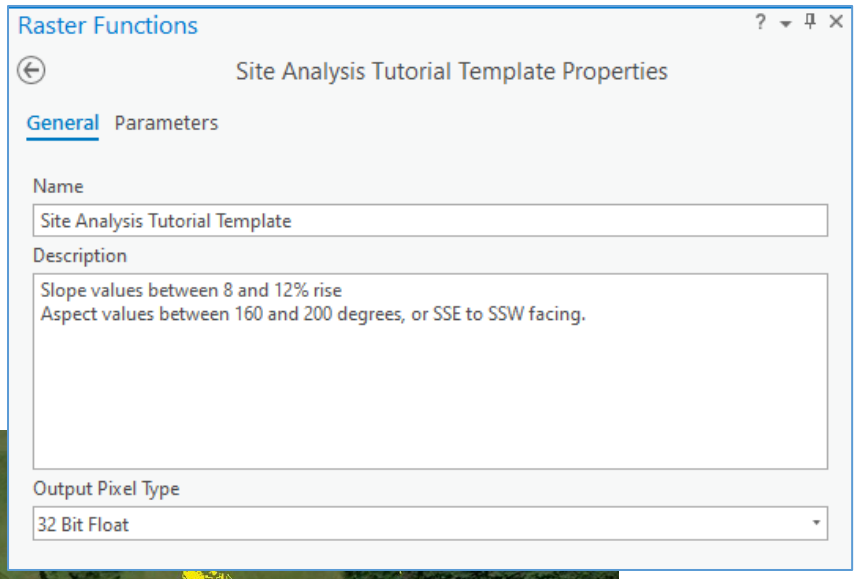


18. Select the Custom tab under Raster Functions pane:



19. Open the custom function template and click





ADDITIONAL RESOURCES

For more information about Maryland LiDAR, please visit the Maryland LiDAR Overview page

For more information about additional training opportunities, please visit the MD iMAP Training Overview page, or contact Lisa Lowe, Senior GIS Analyst with the Maryland Department of Information Technology, Geographic Information Office at lisa.lowe@maryland.gov.

For additional MD iMAP datasets, please visit the GIS Data Catalog

For all other inquiries related to Maryland LiDAR, please contact the GIO Office at service.desk@maryland.gov.